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Abstract. Current literature on urban planning explores how to use ICT to support citizen participation. Advances in open data and its possibility to easily represent data on maps, opens up new opportunities to support participation and decision making in urban projects. This article investigates how spatial planners today use data to inform the participatory process. Looking at the participation process as collaboration between planners and citizens allows us to see the participation process itself as generating data that informs future decisions and processes. Based on a case study of a participatory process of an urban renewal project, the article investigates the use of structured and unstructured data for participation. The fieldwork is conducted using ethnographically inspired methods, based on participatory observations, interviews and document analysis. As a result, the incremental decisions, the resulting process, and the data used in this process are mapped out. Besides the need to accommodate heterogeneous data and to allow for integrated analysis of data specific to the neighborhood under development, the important result is that the participatory process itself generates data that informs the further process and the decisions that are part of it. The paper concludes with design implications for decision support for urban planning. In future research, the intention is to explore these implications in a Participatory Design process.

Keywords: Urban Renewal, Urban Planning, Visualisation, Participatory Design

1 Introduction

Today, municipalities collect and have access to huge amount of data about their city. Additional data is volunteered by citizens through social media platforms like Instagram, Twitter and Facebook. To capture the exploration and use of such data sources, the research reported here was initiated as part of a PhD project. In cooperation with the City of Copenhagen we were able to observe an urban renewal project, through a participatory observation of processes and activities on the project in a community. [1]

[1] The study presented here is implemented in the context of the "UrbanData2Decide" project, a EU-project funded under the Joint Programming Initiative Urban Europe (2014 - 2016).

Urban renewal and urban regeneration projects, are understood as a comprehensive integration of vision and action aimed at resolving the multi-faceted problems of deprived urban areas to improve their economic, physical, social, and environmental conditions [1]. Urban renewal thus combines spatial planning with economic, cultural and social development, and relies heavily on citizen participation to provide input in the decision-making and in order to assure sustainability of changes. Urban renewal projects are prepared and planned in a participatory manner.

Under the heading of Open Data more and more data is provided for the public to access and make use of. Recent efforts in supporting urban planners point towards the use of Open data and social media as an additional data source. The availability of data sources on Open Data portals makes it easy to access, share and integrate data. Further, urban planners realize that social media can provide an additional source of information about issues of a community.

In this article, we discuss and analyze data collected from a field study to answer three research questions: What data is used? How is the decision-making processes structured? And how is data informing the decision-making?
Literature in spatial planning emphasizes the participation process, but does not focus on the role of data analysis in this process. Our results show that, already today spatial planners use both statistic data and unstructured data like photos and texts to formulate proposals for politicians and materials as data used to inform the participatory process. Each disadvantaged area has its specific problems and dimension. This in turn influences the participation process and what data is relevant for analysis. The challenges in most renewal projects are concerned with the collection and analysis of such data, hence the need to analyze heterogeneous data. In addition, we observed an overarching reflexivity in the process. The participatory process itself generates data, which in turn influences the process: citizens tell about their usage of the space; they indicate how they move through the neighborhood and why; they share opinions through surveys and workshops. This data from participation is as much informing the later decision processes as the data provided by the administration. Support for utilizing data for decision processes needs to take this mutual dependency between data and decision processes into account. These empirical results will be used to inform the design for support for data visualization and analysis that informs the participatory decision process.

The ways, in which urban data is used in preparing and planning of urban projects, is geared towards describing how citizens are using their city. Informing citizens about challenges in their communities requires analyzing and designing representations of existing statistics to inform and stimulate participation. Statistical data and data collected from local stakeholders are used to form a basis for discussions. During workshops, ideas are generated from discussions amongst citizens and planners. Citizen contributions are often inspired by personal experiences or insights from statistical data. Decision-making and planning in workshops and other participatory processes is thus invariably shaped by the planners as well as the citizens.

In presenting our case we will show how urban renewal projects are initiated and integrated in the communities, and show how data is used in the process. The aim of the article is to inform the design of data analysis and visualization to support participatory planning, using open data and data from social media. Based on our analysis,

we argue that such support needs to take the reflexivity between participation and data use into account.

The remainder of the article is structured as follows. Section2 presents related work on e-planning and e-participation. The section discusses urban data usage and participatory design (PD) in urban planning. Then in Section 3, we will present the research methods that were used. After which we present our findings from the urban renewal project 'Områdefornyelse Sydhavnen'. In section 4 we present our discussion, and, finally, the conclusions in section 5 sums up the results.

2. Related Work

Research has been discussing planning and the use of ICT for supporting it for some time now, which also resulted in the publication of an International Journal on e-Planning Research (IJEPR). The majority of the contributions problematize the challenges in participation and focus on presenting difference interactive tools to involve citizens in the planning process and discuss how they can be applied in the different planning contexts [14] or propose interactive maps of areas of concern [13][15]. Some articles emphasize the importance of taking into account the situated context when innovating new solutions [13] [14]. However, few articles focus on the role of urban planners in the process or address support for the whole planning process. Also the use and aggregation of data to inform participation is hardly discussed. Even less articles discussed how to deal with the data generated in the participatory planning process to inform future participation or the planning process as a whole.

Although public consultation is agreed to be mandatory in municipal planning, literature on using ICT for supporting planning, by and large does not address the already existing participatory process in municipal projects, nor the data available for informing participation, or how it is used. Although some articles focus on simulations of solutions and mathematical evaluation for participating citizens to explore, they still luck support for a integrating a wide-rage of data including citizen feedback.

A significant amount of journal articles discusses participatory and collaborative planning, with an emphasis on making planning complexities visible. Most of these articles emphasize the new possibilities of participation in the virtual, and bringing participation beyond meetings [13,14,15]. The decision process that is part of all planning processes is hardly explored. Data as input for the participatory process is only presented as maps over the physical environment and as such is not further problematized. For instance in a municipal planning project in Sweden, it was mandatory to conduct a consultation process of municipal comprehensive plans; the resulting e-service aimed to enhance interaction and participation on static maps [14].
In Bugs et al. (2010), the authors report the use of GIS based visualization of alternative scenarios to be discussed among citizens and between citizens, planners and decision makers. Discussions can be navigated based on spatial data saved with the comments. Most of the research focuses on interaction, usability and visualization to support participation[4]. The article does not focus on the flow of data and information between citizens and planners.

A comparative study of tools used in cities in Poland and Germany to foster public participation in urban planning emphasizes three important points for e-planning tools, transparency and spatiality and interactivity. It demonstrates the use of online map base tool which access databases of predefined plans in text and on maps with spatial search functionalities of existing data on the locations discussed. In the cases presented in the article, predefined plans in the form fixed maps and text are used where expert planners provided the searchable data. The article reports research from 2012 where citizen participation in two case cities was based on a given set of activities and on summaries published on the municipal websites [13]. Citizen contributions are elicited through comments on specific forms.

Overall, very little is discussed in the different articles on how data was used in the preparation and design of the maps and for the solution. The limitation from the lack of use of this data is not problematised, nor is the possibility to include additional data discussed. The article by Mayer et al. represents an exception, it discusses decision support tools and simulation games to support participation and decision-making in urban renewal projects [5]. The study uses GIS tool and 3D models to inform participation of different stakeholders from politicians to experts, to provide input into the renewal project and at the same time give feedback on the tool design [5]. The authors suggest that simulation games are interactive and enjoyable, and therefore provide opportunities for participation. In this case participation is limited to a small number of stakeholders and the relation between the parties, data and the decision process is not discussed.

Another source of related literature is the participatory design community, mainly the in form of the proceeding of the PD conference series. In participatory design literature the focus is mainly on user participation in ICT design. However, the community broadened in order to gain inspiration from studying other participatory design encounters. In a recent article, for example the authors investigate walking through the neighborhood as a method for citizen participation in spatial planningand present various existing methodological walking approaches. The article then describes the preparation and implementation of a transect walk with citizen of a deprived neighborhood to generate maps as data to facilitate the participation and innovation and generate concrete proposals for change [17]. Similarly, Eriksson et al. [6] explore the use of a board game in the participatory process. The article focuses on the participation, power and negotiation in the interactions between people and materials. The authors analyzed how the rules in a board game and the physical representations used for it influenced the interaction between planners and participating citizens.

Both, spatial planning and PD literature focus on participatory procedures as the outcome. To understand the dynamics of decision making we, here focus on the practice of the planners preparing urban renewal projects.

The process character of participation in both, design and urban planning, is discussed in depth by Bratteteig & Wagner [12]. Based on a comparison of participatory workshops with the use of novel mixed reality environments in three different urban projects, the authors reflect on the dynamics of the participatory process. The article discusses heterogeneity of site and project, the role of representations and of the participating stakeholders as crucial in opening the space for design alternatives. The article suggest that participatory decision making is an evolving process that is based

on that citizens are given the power to make concrete choices in different participatory activities which in turn inform the final design of ICT artifact or the neighborhood. The article suggests that this concept can be used in better planning and through that improving participation. Here the question is how the results of the participatory process are represented in the further decision-making process.

The research here shares the interest in the participation in the context of ICT design as well as urban planning as an unfolding process [12]. The motivation for our research, though is participatory design for tools, it also looks at their context of use for urban planners to support the participation processes led by them. The focus of the field study that is subject to this article therefore is not only the participatory planning encounter but also the way urban planners already now use data to inform the participatory process and document participation and its results as a basis for future decision steps. In the discussion we will come back to the articles discussed above.

3. Methods

The research took place as part of a research project in cooperation with the technical and environmental section of the City of Copenhagen, responsible for the administration of urban renewal projects. The research applied a case study approach with interviews, participatory observations and analysis of documents to observe and partly reconstruct the preparation of an urban renewal project. A field study was conducted on a renewal project that took place in Sydhavnen.

Fieldwork was conducted from two main locations, the Municipal offices and the Sydhavnen neighborhood. Municipal teams (planners) were observed as they performed their duties on site, with and in the neighborhood, and in their offices. From this process the activities were documented, and ambiguities that emerged were used to prepare questions for future interviews. Further information was acquired through interviews and analysis of project materials.

The researcher had to immerse himself into project preparation and its activities to collect data from on going campaigns, workshops and meetings that took place between citizens and planners. Data was collected through audio and video recordings, photos, field notes and actual sample data and materials distributed at participatory events. Transcriptions from audio and video recordings were authored in accordance to the process.

The analysis focused on understanding how people worked in the project and how data, information and documentation were moving between the planners and the citizens. The analysis of the materials provided understanding of how planners organized their practice. The structures in the planning activities and team members learning formed the flow of data and documentation among planners and citizens in the project preparation process. Based on the temporal analysis, a number of themes were identified for further analysis in an axial coding manner. The current article explores one of such themes in depth.

The following measures were taken to assure the trustworthiness of our results. The analysis of different data sources allowed us to triangulate our findings and

achieve a deeper understanding of the subject. It also ensured that we did not understand things the wrong way [7]. We, further, conducted regular debriefings within the research team, and, where necessary, the less involved of the authors took over the interviewing (researcher triangulation) [11]. As part of our first Participatory Design (PD) workshop, we presented a temporary analysis and asked the members of the technical and environmental administration to complement our findings (member checking). Based on the results, the following presentation of the results can be expected to provide a trustworthy account of the planning process.

4. Research Findings

Citizen participation in urban project is a requirement embedded in guidelines and laws guiding urban projects. The planning and design of citizen participation, though, is uniquely tailored to each individual renewal project and the area's needs. It requires deeper understanding of the areas prior to the project preparation. The ministry of city, housing, urban and rural areas of Denmark, prioritizes and co-funds the urban development projects [8]. The city of Copenhagen complements the national policy with a municipal one for disadvantaged areas in Copenhagen [9]. The policy details the focus, objectives, goals, development plans and strategies to be adopted by urban renewal projects. In addition, the policy emphasizes the use of the department of spatial and urban renewal, in which municipal planners collaborate with local stakeholders and the community and with other municipal administrations to improve disadvantaged areas. The disadvantaged areas are characterized as areas, which have stagnated in relation to the overall development of the city [9]. Democratizing urban renewal processes in such areas requires that the socially marginalized be represented well in the participatory process and decision-making. Urban renewal projects normally can acquire funding through municipal applications which can apply up to 10 million DKK (1.32 Million EU) for each individual project [10].

For this research we conducted a field study on a renewal project in Sydhavnen, "South Harbor". Sydhavnen and other areas were among the enlisted areas to be addressed under the urban renewal policy to promote new, positive development in the area. The areas were selected based on a fixed set of criteria. Sydhavnen consists of part of the former industrial harbor of Copenhagen that is being transformed to house modern apartment buildings and service industries and is adjacent to a traditional working class neighborhood. Sydhavnen was selected because of the contrast between the two areas, in which the old area had small social housing flats with shared bathrooms, and the new had larger modern housing at the harbor front. The study was used to map out the decision-making process and the participatory processes between the municipality and the Sydhavnen residents participating in the urban renewal exercise.

In presenting the case study, we begin a presentation of the central stakeholders and thereafter present the application preparation and preparation phases in a temporal manner.

4.1 Stakeholders

An important part of urban renewal projects is the involvement of the local stakeholders and the community. To create a sustainable change to a neighborhood, the individual sub-projects need to be supported locally. Urban renewal projects involve a heterogeneity of stakeholders: planners, citizen, community stakeholders, local councils and organizations from the public and private housing sectors, clinics, schools and libraries are usually directly involved in the projects from the beginning to the end. Members of the planning team have different professional backgrounds, with not only different foci, but also work with different data and different aspects of the planning processes. In the Sydhavnen renewal project, architects, sociologists, and spatial planners were involved who when necessary had access to experts e.g. on low-energy housing.

Based on the interaction between the planners and citizens, the planners took on the role of facilitators, where they guided participants in the discussion of complex topics. The different profession backgrounds of the team members allowed the team to flexibly react on issues raised by the citizens. The team members supported and complimented each other.

A central issue is to understand how citizens and the community use their neighborhood, and how they would like to use it. Team members therefore collected data from citizens as part of the participatory encounters. The more senior planners continued to perform analysis of statistics to complement the qualitative data. While the team leaders coordinated the processes and the activities, member responsibilities and competencies overlapped throughout the project processes.

Parallel to the process to involve the community as broad as possible, the members of the team contact community stakeholders like the local libraries, the principal of the school, the shop owners, or the local sports club. These community stakeholders provide both additional insights into the community and resources concrete sub-projects can build on. Many of the sub-projects identified can only be implemented in cooperation with these stakeholders. Improvement of subsidized housing e.g. needs to involve the social housing organization owning the apartment buildings.

4.2 From proposal to implementation

In this section, we describe the project in detail. The process is illustrated in figure 1. The numbers in the figure are referred to the ones in the remainder of the description. The investigation on the Sydhavnen project, focused on the preparatory phase of the project as the majority of decisions on specific actions and sub-projects are taken during this period. The earlier process is reconstructed from interviews with the planners.

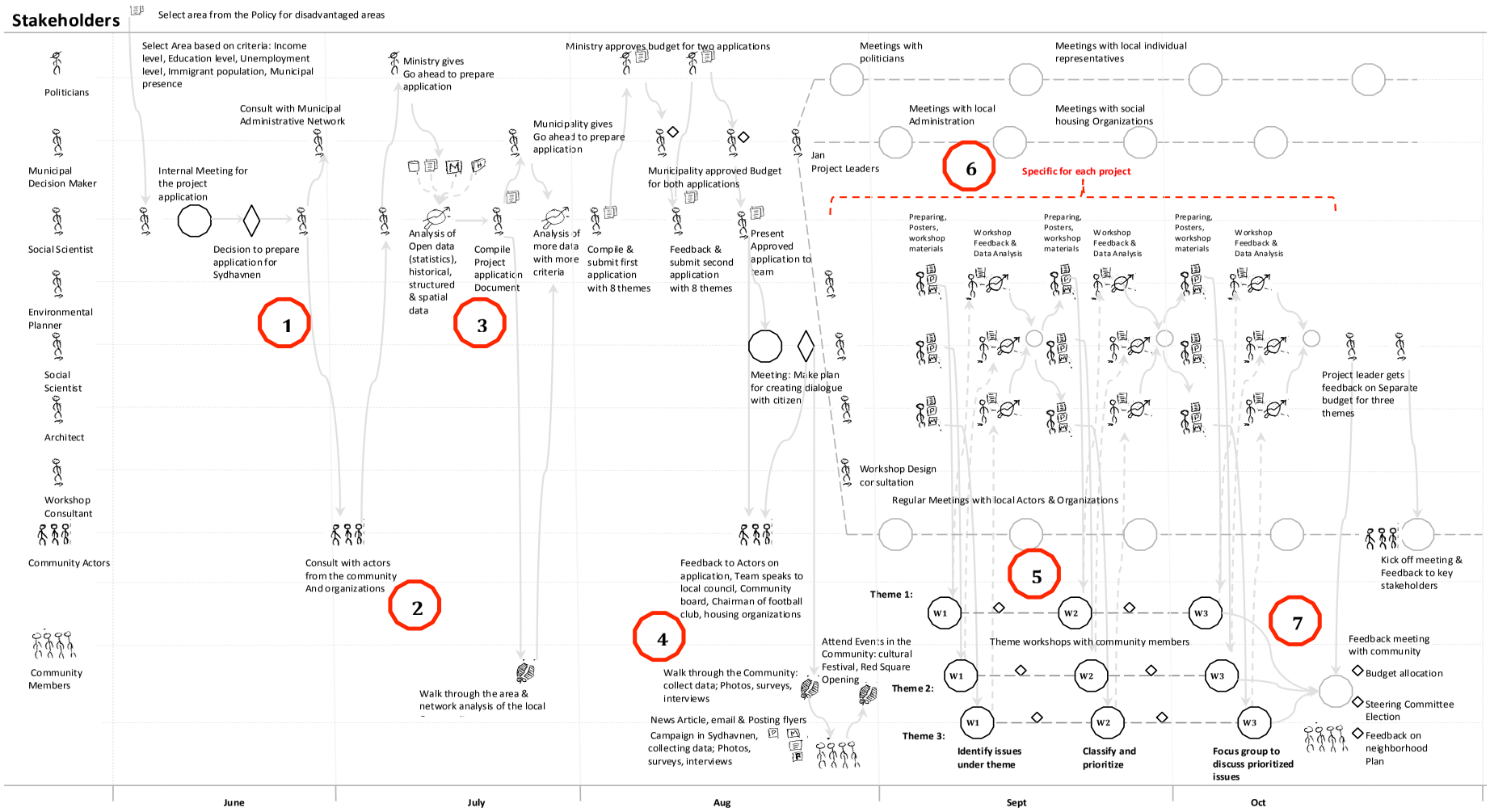

Fig.1: Map over the Sydhavnen process

4.2.1 Application preparation

Based on the policy, the project begins with a pre-study of the selected area. Sydhavnen was selected among areas shortlisted for development by the municipality. (1) This process starts by collecting data from different sources and exploring existing data, in the form of socio-economic maps that visualize data from different levels down to administrative squares. The data is collected based on a fixed set of selection criteria such as physical infrastructure, socio-demographic and economic data detailed in the municipal policy for disadvantaged areas. (2) Qualitative data is collected from a trip through the area and interviews with local people who have an influence in the area e.g. community workhouses, businesses and local politicians all to identify physical and social challenges. The result was used as input to compile a project proposal to the municipality. The Sydhavnen proposal was the one chosen from 2 alternatives.

(3) With a positive go ahead from the municipality on the investigation, the preparation process continued in Spring 2014, involving more actors determining specific challenges of the area. This began with further consultation with local council members and community stakeholders. Other data about the history of the area is collected from library archives. Then further analysis of statistic data using up to 30 – 40 criteria was done. More data from different sources about flooding basements was collected from building owners and civil organizations. In spite of previous analysis more analysis of statistic data and information from the community stakeholders was done and used to develop an application that is submitted to Ministry (MHURS). The application highlighted 8 challenges to be addressed in the renewal project. Once the ministry approves the application and reserves funding for the project, the municipality also approves the budget for their contribution to the project.

4.2.2 The Preparation Phase

Already parallel to the decision by the ministry, an interdisciplinary team is assigned for the preparation of the project. (4) The team takes concrete actions and begins to design the participatory process and the engagement with the citizens. The eight challenges were narrowed down to three themes in order to be able to handle the complexity in the participatory process. The engagement process with Sydhavnen began with first contacting citizens via mail posts, attending community events, such as the opening of a central square and cultural festivals. The team then marked their presence with a campaign stand in Sydhavnen, for which they prepared maps, surveys, flyers, posters games, food and music to engage with community. At this event residents volunteered to take part in the workshops series focusing on of one of the themes. The discussion at the public events also provided the team with the opportunity to learn about the normal residents' perspective. This is facilitated through explicit methods: For example citizens were invited to fill out a short survey over good and bad aspects of living in Sydhavnen; they could place smileys and other icons on maps in order to indicate their mood with respect to places in the neighbor-

hood; already in the early encounters, the planning team interviewed citizens about where they walked and cycled; how they moved in the area.

(5) Three workshop series are held, exploring the three themes: 'Life between buildings' focusing on the physical infrastructure; "social, culture and leisure time"; and "Energy, climate and sustainability" focusing on sustainability with respect to traffic and houses. In the workshops, the planners and citizens discussed challenges and came up with ways to address the challenges, which resulted in a number of sub-project proposals.

(6) Parallel to the participation process, are regular ongoing meetings between the project manager of the planning team and the community stakeholders. During this process, the planners conduct continuous analysis of data taking into account the input from the participatory processes. In this process new development opportunities to build on in the project are identified by the citizens.

(7) The team compiles the results from the workshop and allocates budgets, which the presented at a last meeting 'feedback meeting' for the community where the team presents and motivates the results. A steering committee is elected. The neighborhood plan is finalized and, after yet another decision on a political level, the implementation begins.

5. Discussion

From the empirical finding of the research we will discuss a number of points that contribute the ambiguity between data used for participation and the data generated from it. A significant lesson from the urban renewal case in Sydhavnen is not only that data is analyzed and prepared to inform the participatory process, the participatory process is also treated as producing data that itself informs the future (participatory) decision process. As our related work section shows, current literature does not address the reflexivity between the planners' use of data for designing participation and the data generated in and through the participation and how this mutual dependency affects urban project processes. The first three subsections of the discussion focus on how urban planners both use data and document the 'participation as data'. The last subsection points to design implications for supporting urban planners and the participation process as a start for future research.

5.1 Participation changes the process of the preparation phase

Renewal projects in Copenhagen are based on long-term development goals that have to be initiated and prepared in the beginning of the project. The analysis of various kinds of data available prior to the participatory process – statistics, social-economic and qualitative data – was discussed in interviews with the planners. The data is used in the beginning to create a baseline argumentation to support municipal intervention in a particular neighborhood. Based on this initial analysis the initial plan for the participatory process is prepared. Each project organizes the interaction with the community differently. However, the process itself is a reflexive one. In the analysis

above, we see that citizen participation generates data that then leads to changes in the course of the further process and content. One example is that a survey on positive and negative aspects of Sydhavnen in the initial campaign was in depth analyzed and used to scope the work in the workshops. As another example, the results of one workshop identifying and prioritizing issues are used to structure the following workshop discussing the issues highest on the prioritized list in order to develop project ideas to address them.

As we came to understand, the central variations between renewal projects were in the participatory process. Each community has its own structures, culture and challenges. There is no fixed method of participation or how to identify the specific challenges. Initially, planners structure the project, the participation and materials used depending on the how they understand the context. In the Sydhavnen project, planners attended cultural events, which worked well to maintain a presence. In another neighborhood, a project began with a community dinner leading to the formation of discussion groups and workshops. The understanding of the neighborhood and its challenges, though, develops as the participatory process unfolds. (See also [2]) Planners consciously design activities to collect, analyze and interpret data from community members directly or generated through the participatory encounters. Planners mention that knowing how, where and when participation is required comes with experience from different projects. Therefore planners need to know the context of the neighborhood. This in turn gives each project a unique structure.

5.2 Citizen participation changes data requirements

Changes in data requirements continuously take place throughout the process. Data analysis and the participatory decision process are mutually dependent. On the one hand, the analysis of data is used to design and plan the participatory process and to inform the collaboration with citizens in concrete events. On the other hand, the participatory process creates data and triggers the exploration of additional quantitative and qualitative data.

As the process differs from project to project, so do the data and its analysis. Further more, it is not given in the beginning what data will be necessary. For instance, in the Sydhavnen project, one of the planners reported that when collecting data, he met with members of the community who reported about annoying traffic noise in certain areas. Based on the information, he returned and looked for existing data on the topic when he comes back to the office and finds a noise map over the area depicting an earlier analysis.

This suggests that suitable technological support for the data analysis in urban renewal should not have fixed functionality and the planner need to be able to find access and analyze data not anticipated from the beginning.

Maybe because the majority research having the individual participatory encounter as a focus, the reflexivity of the process is not addressed in the current literature. It points to again the general patterns in the changes in data requirements and analysis in and across urban projects. The planners mentioned in the interviews that the contingent and evolutionary way of interacting with the community and analyzing

data helps to identify patterns and issues affecting the community which otherwise would have gone unrecognized. These patterns and issues then inform the exploration of additional structured data. One of the spatial planner stated, 'from the sea of statistics there are mountains sticking out describing the problem.' These problems then inform the later participation process.

5.3 Ambiguity in the role of planners and citizens

The role of the planners and citizens in this process are ambiguous:

Planners, on the one hand, need to nurture the participatory processes by *instructing*, *listening*, *encouraging*, and *empathizing* with participating citizens. One of the planners stated that 'we need to build up trust by meeting people face to face to get them to give some information.' On the other hand, they need to ensure that the goals in the end specified by the citizens are in line with the policies and the funding possibilities. They act as a mediator between the administrative and political constraints and the local community. This has also been discussed in [planning game], where the researchers observed how the planner facilitating the board game used rules to guide the decisions on specific sub-projects. In the planners' communication with political and administrative actors the documentation of the results of the participatory process provides the necessary accountability.

But also citizens are requested to take on different roles in the participatory process. They acted as experts when sharing knowledge about their neighborhood. They were asked as designers and deciders to prioritize issues and sub projects; at each point in the participation process citizens were encouraged to communicate their ideas and to make decisions to drive the project. And citizens provided data, e.g. about how they moved in the neighborhood, that was used to inform the participatory process and guide planners.

In the next section we further discuss the data generating aspect of participation.

5.4 Citizen participation generates data

While the data analysis is used to inform the participation process, the participation process itself generates data and is consciously organized to do so. As the main rationality voiced again and again in our interviews and the initial design workshop, the planners mention the need to understand how the community members use or want to use the spaces and places in their neighborhood. 'People normally use one station as apposed to using the other station in Sydhavnen because the other station feels less safe.'

And they would like to develop as broad a picture as possible. As there are not only individuals involved, but a whole community, whose input needs to be aggregated and systematically analyzed as well. For instance, the team of planners analyzed the initial survey in the Sydhavnen project by categorizing the answers, as one would analyze qualitative research data. Citizens generate data when interviewed about how they move in the neighborhood, which routes they use at what time of the day. These

movement patterns are indicative of places where traffic routing might need to be changed. Also the workshops in and with the community are documented to inform the design of the following workshops and provide input for the political decision process.

Some of the participatory processes are specifically designed to gather information from the citizen e.g. the planners use maps at the campaign stand to collect movement patterns of citizens, and emotional maps to collect data about what citizens felt about certain areas of their neighborhood. Other activities are planned to identify issues, to generate ideas, and to decide on subprojects. However, these are conscientiously documented, and they in turn inform the further process as well.

5.5 Design implication for and potential of new technology

What do the empirical findings above now imply for the design of support for data visualization and decision-making? Based on the empirical work and from the discussions presented we can identify potentials for future design as well as a number of requirements to support both participation of citizens and the work of the planners involved. One distinguishing feature of the research above and the design implications is that the focus is not only on the individual participatory encounter but also on the reciprocity between the urban planners' work with exploring, aggregating and representing data both for themselves and for the community and other stakeholders and the series of participatory encounters and structures of participation that together account for the participatory process.

5.5.1 Data for Participation

The article started out by asking what data is used and how does it inform the planning process. The related work section shows that this is often not discussed in the relevant literature. Based on our fieldwork we can conclude, that, first and foremost, the support for the team driving the urban renewal projects needs to be able to search and analyze data in a flexible manner. Data facilitates decision processes and the participatory process triggers new data requirements from different sources. In projects reported in literature, static maps with fixed data are used to support participation and decision methods in PD. The need to flexibly integrate heterogeneous data sources is not addressed. In renewal project subject to our research, data was acquired from multiple sources. Experts performed analysis on the data at different stages of the process combining qualitative and quantitative data. As we see from the case the central quantitative data used is provided in form of a socio-economic map. Other statistical data is provided through the Comprehensive Knowledge Archive Network (CKAN)[2], an open source, web-based data management system used for storage and distribution of data. Qualitative data from discussions and interviews is analyzed using methods like categorization and coding. Providing the possibility for

[2] http://ckan.org

housing collections of data from various sources in a flexible way and for aggregating this data can reduce repetition of data pruning and analysis tasks.

Planners require a better overview of what data is available from other team members or in the municipality as a whole. They require a platform to use for the distribution of their analysis and data. Further, web based tools or social media can be used to mediate participatory decision making methods and serve as an additional data source.

5.5.2 Participation as Data

One of the central issues for the project team in the planning process is to understand the issues and problems of the community members in a neighborhood. This is especially an issue as in many of the targeted neighborhoods the percentage of people with foreign backgrounds is high. In the Sydhavnen case planner's mention that they need to find was of how to reach out to the foreign community members. Furthermore, the participation process is based on self-selection resulting in an over representation of elderly citizens. 'The average person we get response from is between 45 and 75, they are the only people with the time to really attend these events', one of the planning team members mentioned. Families with kids are just too busy to get involved. Focusing on data generation aspect of participation could be a way to deploy the social media and big data technologies to maybe not have the voice of the non-participating citizens heard but to invite them to add their data to the scale.

Let us follow your movements for a week
Methods for exploring movement patterns of citizens are already now essential for project preparation process as a way to inform citizens and planners about how the community members use their neighborhood. However current literature does not discuss these methods in detail. In practice the data collection techniques often involve pre-decided environments, like specifically prepared maps or joined walks [6]. The result of such techniques does not collect data about actual movements. Modern mobile technologies allow providing and gathering data about movements as part of everyday activity. In this scenario a citizen could download a mobile app and enable the GPS functionality on the cell phone and go about their daily activities. The data would be collected over a period of maybe one to two weeks at a server and visualized on maps. This GPS data as feedback from citizens in action to planners eliminates the challenge in presenting data to citizens to collecting or generated data.

Show me the best and the worst of your neighborhood
Social media is already now used in participatory planning to broaden the discussion by providing a web-based channel for communication. This can be done systematically by categorizing and analyzing the semantics of data mined from twitter and Facebook. However, such methods still exclude citizens who shy from participation because they perceive that they lack the necessary language skills to express themselves. Here, the usage of instagram and other picture based social media provides new opportunities: Photos e.g. of the best and the worst could be added to the data

used and produced in the workshops, and ultimately informing the next participatory process.

Based on our observations, the central result is the reflexivity of the process, where citizen participation generates data that then leads to changes in the course of the further process and content. This then implicates requirements for tool design: they need to provide enough flexibility to support such a process. Other design implications are generated from looking at participation as data. The results reported here provide a number of suggestions for data-based support for extended collaborative planning processes which we want to explore in future research. The next steps could be the organization of future workshops to explore the new data sources and how to visualize them.

6. Conclusion

Urban renewal projects require different approaches to address problems of each specific neighborhood. This, in turn, is responsible for that projects and the participatory decision processes are structured differently. In references to our three aforementioned research questions we observed the following; in the first, we distinguished that renewal projects use existing qualitative and quantitative data, including governmental open data alongside generated data from the participatory process to support further action. Urban planners exploit heterogonous sources of data. In addition, the participation and the data to be analyzed are not fixed. With respect to the second and third question, we can observe a reflexive relation between the participatory process and data used by planners while preparing and facilitating the process. The participation process itself generates data that is used to design the further participatory processes and the materials to be used. This leads to a number of possible design implications for flexible technological support for planners, addressing both the data analysis and participation of citizen.

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